DTIC FILE COPY

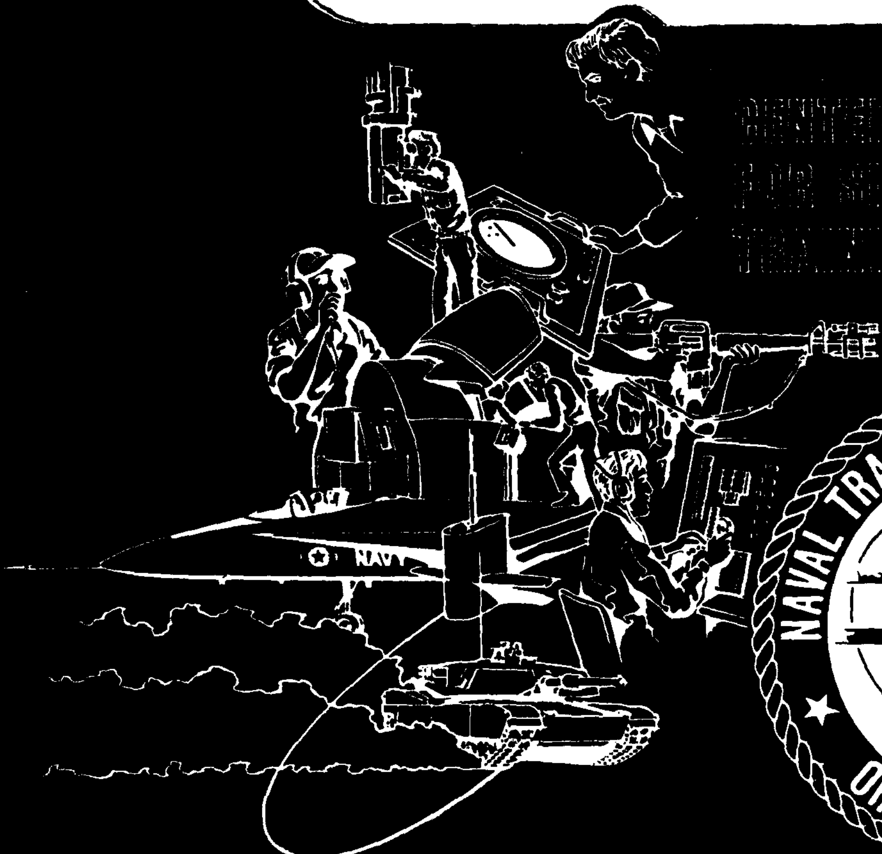
(4)

NAVAL TRAINING SYSTEMS CENTER

ORLANDO, FLORIDA

AD-A203 885

CENTER OF EXCELLENCE FOR SIMULATION AND TRAINING TECHNOLOGY



NAVAL TRAINING SYSTEMS CENTER
ORLANDO, FLORIDA

SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) Technical Report 88-017	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Naval Training Systems Center 6b. OFFICE SYMBOL (If applicable) Code 121	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) Naval Training Systems Center 12350 Research Parkway Orlando, FL 32826-3224	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)

Impact Analysis for Research and Development Programs

12. PERSONAL AUTHOR(S)

Timothy C. Whitten, Eric K. Green, William C. Rankin, Joan P. Brannick

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM ____ TO ____	1988 August	

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Training Effectiveness Evaluation, Impact Analysis, R&D, Life Cycle Cost Analysis, Psychology. (JES)
05	08		

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

All Research & Development project/programs differ in purpose. The future impact of R&D efforts is difficult to determine and often there are no usable data for evaluation since there is no generally accepted or universally applicable method for predicting a program's worth. Being able to evaluate the future impact of R&D programs could provide useful information to many people. Principal investigators could use this information to "sell" their projects, and project sponsors could use this information to evaluate programs and make important decisions about funding, acquisition, implementation, etc. The Naval Training Systems Center (NAVTRASYSCEN) Training Analysis and Evaluation Department was requested to develop means to assess the impact of R&D programs on the Navy. Training effectiveness estimates and cost estimates were collected from four NAVTRASYSCEN R&D programs using the Device Effectiveness Forecasting Technique (DEFT), the Research and Development Impact Analysis (RDIA), and a standard life cycle cost analysis. The collected data indicated that the four R&D programs would be training effective. Moreover, the cost

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION
22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code) / 22c. OFFICE SYMBOL

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

TECHNICAL REPORT 88-017

IMPACT ANALYSIS FOR RESEARCH AND DEVELOPMENT PROGRAMS

AUGUST 1988

Tim Whitten
Eric Green
William Rankin
Joan Brannick

NAVAL TRAINING SYSTEMS CENTER
Orlando, FL 32826-3224

~~Distribution authorized to U.S. Government agencies and their contractors; Administrative/Operational Use, August 1988. Other requests for this document shall be referred to Commanding Officer, Naval Training Systems Center (Code [illegible]), 12350 Research Parkway, Orlando, FL 32826-3224.~~

DESTRUCTION NOTICE
Destroy by any method that will prevent disclosure of contents or reconstruction of the document.

R.D. Jarvis

R.D. Jarvis, Head
Training Systems
Evaluation Division

T.W. McNaney

T. W. McNANEY, Director
Training Analysis and
Evaluation Department

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

THIS PAGE INTENTIONALLY LEFT BLANK

19. ABSTRACT (Cont.)

estimates for three of the four programs were lower than an alternative training system. A general methodology is recommended for performing an impact analysis, and guidelines for determining appropriate instruments for collecting data are proposed.

Technical Report 88-017

ACKNOWLEDGMENTS

Appreciation is expressed to the following persons for their contributions to this study:

Dr. Mark Pfeiffer, NAVTRASYSCEN, Orlando, Florida, for technical consultation.

Mr. Jeff Horey, NAVTRASYSCEN, Orlando, Florida, for editorial review.

Distribution Statement A is correct for this report.
Per Mr. Douglas A. Palosaari, NTSC/Code 423

THIS PAGE INTENTIONALLY LEFT BLANK

EXECUTIVE SUMMARY

All Research & Development projects/programs differ in purpose. The future impact of R&D efforts is difficult to determine and often there are no usable data for evaluation since there is no generally accepted or universally applicable method for predicting a program's worth. Being able to evaluate the future impact of R&D programs could provide useful information to many people. Principal investigators could use this information to "sell" their projects, and project sponsors could use this information to evaluate programs and make important decisions about funding, acquisition, implementation, etc.

The NAVTRASYSCEN Training Analysis and Evaluation Department was requested to develop means to assess the impact of R&D programs on the Navy.

Training effectiveness estimates and cost estimates were collected from four NAVTRASYSCEN R&D programs using the Device Effectiveness Forecasting Technique (DEFT), the Research and Development Impact Analysis (RDIA), and a standard life cycle cost analysis.

The collected data indicated that the four R&D programs would be training effective. Moreover, the cost estimates for three of the four programs were lower than an alternative training system. A general methodology is recommended for performing an impact analysis, and guidelines for determining appropriate instruments for collecting data are proposed.

The nature of R&D is dynamic and changing. Therefore, the data presented here (gathered May - June 1988) may be subject to refinement.

THIS PAGE INTENTIONALLY LEFT BLANK

Technical Report 88-017

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

TABLE OF CONTENTS (Continued)

THIS PAGE INTENTIONALLY LEFT BLANK

INTRODUCTION

The annual Science and Technology Review gives the Naval Training Systems Center (NAVTRASYSCEN) Research and Development (R&D) Department (Code 7) the opportunity to present ongoing projects/programs to their sponsors or potential sponsors. An action item originated from the 1987 review concerning the need for inclusion in the presentations of R&D projects an estimate of the likely impact of the work in terms of cost and effect. Subsequently, Code 7 requested the Training Analysis and Evaluation Department (Code 1) of the NAVTRASYSCEN to develop an approach and guidance to assess the impact of NAVTRASYSCEN R&D projects. The approach was to include a methodology that could be applied to each R&D program to produce estimates of cost and effectiveness. Not only would these estimates predict potential impact on the Navy, but they would give the principal investigators additional information for "selling" their projects/programs. Moreover, the estimates would provide data for the sponsors and potential end-users to base decisions; e.g., whether to continue funding a program or whether to increase funding in order to modify a program.

A straightforward rationale such as that represented in Table 1 could then be applied. For example, if the training effectiveness of the alternatives is different and the life cycle costs are equal, the rule states to select the alternative with the highest training effectiveness estimate (note: an existing training system could be an alternative). Although this rationale appears simple, acquiring the means to make rational selections is much more difficult. The difficulty stems from the need to make decisions at times when the kind of information necessary for making the decisions is not available or of dubious quality.

Figure 1 graphically depicts a time cycle for R&D programs. Early on in the cycle various alternatives are proposed which will make a positive change in the status quo. Once an initial funding decision is made for an alternative, the R&D program crosses over into an area in which decisions about the product will not necessarily be made relative to the status quo. Decisions within this area are usually concerned with the program's potential impact or future worth. This report deals with R&D programs which fall somewhere in this area, i.e., between the initial funding decision and the implementation decision. Consequent to this time frame is the availability of useful data. As an R&D program moves from the initial funding decision to the stage in which a decision can be made to implement the product, more useful data should become available.

Table 1

Decision Rules for Choosing Alternatives

Training Effectiveness of Alternatives	Life Cycle Cost of Alternatives	Rule
Different	Equal	Select alternative with highest training effectiveness
Equal	Different	Select alternative with lowest life cycle cost
Different	Different	Select alternative with higher training effectiveness and lower life cycle cost
		None - subjective

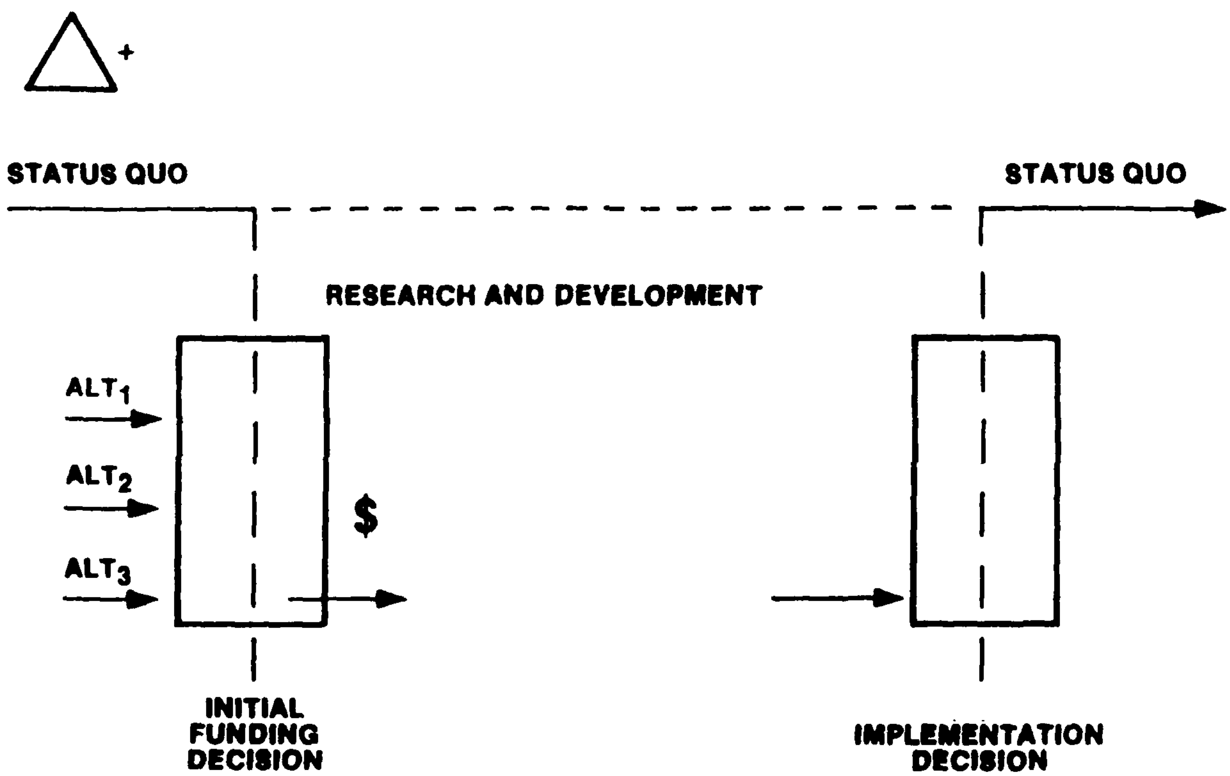


Figure 1. R&D Program Cycle.

Additionally, after an implementation decision has been made, then subsequent decisions may be compared with the status quo; e.g., how does the finalized product compare with that which is already in existence?

While presenting the background, the timing of decisions and information availability are further discussed. Also, presented is a justification for using analytic techniques versus empirical approaches to gain necessary information.

BACKGROUND

Rose, Wheaton, and Yates (1985) pointed out that ultimately the purpose of decisions during device design and development is to insure that an initial and sometimes vague training concept is translated into cost-effective training equipment which will eventually be placed in the field or at a school. Accordingly, they noted, decisions can be based on progressively better data; e.g., more detailed and precise information about the training requirement becomes available, the physical and functional characteristics of the training system which satisfies the requirement become less abstract, and information about how the system will be used becomes better understood. Consequently, estimates of system effectiveness and cost should become more concrete well after the initial concept formulation.

During training system design and development, empirical data are not usually available for making decisions. Empirical evaluations, when conducted, usually take place after the training device is ready for training (RFT). Many R&D efforts are only concepts and demonstrations with no specific application in mind, thus making it nearly impossible to conduct empirical evaluations that are germaine to a particular training setting. Moreover, when empirical data can be gathered, one must be sure the methodology includes carefully designed and well-controlled experiments (Pfeiffer, 1987). These experiments can be costly and difficult to administer. Similarly, decisions made during R&D follow the same limitations; Cordell and Nutter (1983) concluded that the most appropriate methodology during R&D, prior to the device being RFT, involves using analytic techniques.

As an aside, a very important point is that prior to the principal investigator's efforts to collect analytic data, the principal investigator should determine if there are any similar products already in use. If so, data from a similar product can be collected and used to base estimates. Although the chances of finding a similar product may be slim, if a similar product can be found, this avenue, i.e., reasoning by analogy, may save the principal investigator time and money. Furthermore, data from actual products may produce better estimates.

ORGANIZATION OF THE REPORT

The remainder of the report addresses analytic and cost estimation techniques for assessing the impact of R&D projects/ programs. The next section describes two training effectiveness forecasting models which were chosen for their applicability and flexibility. Also included in this section is an explanation of an approach for cost determination. Following that is a brief description of the four selected R&D projects along with results of applying the proposed approach. Finally, a summary of the data and guidelines for administering an impact analysis is provided. Appendices A and B contain copies of the instruments which were used to obtain impact estimates for the four selected R&D projects.

THIS PAGE INTENTIONALLY LEFT BLANK

RECOMMENDED APPROACHES

The reader should recall that the decision rules for choosing among alternatives (Table 1) require an assessment of effectiveness and cost. This section contains some recommended, general approaches to the estimation of effectiveness and cost of training R&D efforts. It should be emphasized that the approaches discussed appear reasonable and suitable for use; however, the individual R&D project will necessitate some modification or tailoring of method. It is the intent of this section and the examples to provide the reader with sufficient structure and insight to adapt the approach to the specifics of a particular R&D impact assessment situation.

Rose, Wheaton, and Yates (1985) suggested that an ideal methodology for analytically evaluating (or forecasting) the effectiveness of a training device (readers may substitute training R&D product for device) would have several properties. The methodology would be:

- applicable at different stages of device design and development;
- diagnostic;
- easy to use;
- supportive for different levels and types of decisions.

The Device Effectiveness Forecasting Technique (DEFT) and the Multi-attribute Utility (MAUT) method are two analytic methods which meet these properties and, therefore, were examined as potential candidates to apply to four R&D programs/projects selected by the NAVTRASYSCEN R&D Department. Both models had to be modified in order to apply to the four projects. The MAUT required the greatest number of modifications and was renamed the Research and Development Impact Analysis (RDIA). Description of the DEFT, the general MAUT method, and the RDIA follow.

DEVICE EFFECTIVENESS FORECASTING TECHNIQUE (DEFT)

The DEFT was developed through a joint effort by the Army Research Institute and the American Institutes for Research. The following summary account of DEFT is based on the detailed description provided by Rose, Wheaton, and Yates (1985). The DEFT is a combination of four major analyses:

1. Analysis of the training problem
2. Analysis of (skill) acquisition-efficiency
3. Analysis of the transfer problem
4. Analysis of transfer-efficiency.

__Analysis of the training problem__ is examining the deficiency in skills and knowledge of the typical trainee relative to the trainee's criterion performance on the training device. That is, how deficient is the typical trainee in the desired performance prior to being introduced to the training device? The criterion performance is the expected performance on the device, not the operational equipment. This analysis also takes into account a typical trainee's difficulty in learning to overcome the deficit.

__Analysis of (skill) aquisition-efficiency__ deals with the quality of training. Which instructional features and training principles does the device have which will help the trainee to overcome his/her deficit?

__Analysis of the transfer problem__ looks at the remaining deficit of the trainee in operational criterion performance. That is, once the trainee has completed device training, what is the trainee's remaining deficiency? The functional and physical similarity between the training device and the operational equipment is also analyzed.

__Analysis of transfer-efficiency__ investigates how well the device promotes transfer of learning to the actual equipment.

The total effectiveness score is a composite of these four analyses. Figure 2 illustrates how the DEFT score is computed. The (skill) acquisition index is derived from the first and second analyses; i.e., analysis of the training problem and analysis of (skill) acquisition-efficiency; and transfer is derived from the third and fourth analyses, i.e., the analysis of the transfer problem and the analysis of transfer-efficiency. Since the magnitude of skill acquisition depends on the magnitude of the training problem and how efficiently the device teaches the trainee, the training problem index is divided by the (skill) acquisition-efficiency index; the transfer index is similarly computed by dividing the transfer problem index by the transfer-efficiency index. In the end, the DEFT provides a total score which is a numerical estimate of device effectiveness. Additionally, by looking at the composite scores, diagnostic information of potential strengths and weaknesses may be examined. For example, a high total score could be the result of any one of the four analyses being high or a combination of any of these analyses being high. The authors question the usefulness of a single composite score for other than comparing one alternative with another. More useful effectiveness information is contained in the acquisition and transfer analyses scores, themselves.

TOTAL EFFECTIVENESS = (SKILL) ACQUISITION + TRANSFER
(SKILL) ACQUISITION = TRAINING PROBLEM / ACQUISITION EFFICIENCY
TRANSFER = TRANSFER PROBLEM / TRANSFER EFFICIENCY

Figure 2. Computing a DEFT Score.

The DEFT embraces a variety of subjects, skills, and dimensions. This versatility makes this method ideal for applying to R&D projects/programs. However, the quality of DEFT data depends on the detail of the available information and the diagnostic ability of the analyst. Modifications of the DEFT as applied to the selected programs are presented in Appendix A.

MULTI-ATTRIBUTE UTILITY (MAUT) METHOD

The MAUT method assesses relative preferences for possible outcomes of a decision that can be represented on several dimensions (Hogarth, 1987). Hogarth (1987) subdivides the approximately ten steps within the MAUT into four subgroups:

- Structuring the Problem
- Determining the Importance of Dimensions
- Measuring Alternatives on the Dimensions
- Making a Choice.

Structuring the Problem consists of: 1) identifying the decision maker(s); 2) identifying the decision (what? and why?); 3) identifying the alternatives; and 4) identifying the dimensions on which the alternatives will be evaluated.

Determining the Importance of the Dimensions consists of: 5) rank-ordering of the dimensions in terms of importance; 6) translating the rankings into ratings (basically assigning weights to the dimensions); and 7) converting ratings to numbers.

Measuring the Alternatives is simply; 8) evaluating each alternative across all dimensions; and 9) calculating each alternative's score as weighted by the appropriate importance weights.

Making a Choice is: 10) Choosing the alternative with the largest assessment of worth.

Choices based on worth do not necessarily indicate that the attributes were ranked and rated according to cost factors. Although importance weights can include costs, usually costs are determined separately and predictions/evaluations are based on a combination of sources. This combination of information sources can best be explained by tne following example.

Table 2 shows how a MAUT method would compute scores for five alternatives: interactive videodisc (VIDEOD), instructor-led group discussions (INSTR), videotape (VIDEOT), exercises in

Table 2
Evaluation of Media Alternatives
for Instructional Problems

DIMENSIONS	WGT	VIDEOD	INSTR	VIDEOT	WBK	35MM
Safety	3	4	5	3	2	1
Motivation	3	4	5	3	1	2
Communication	3	5	2	4	1	3
Practice	3	5	3	2	4	1
Standardization	3	5	3	2	4	1
Time	3	5	4	3	2	1
Info Disem	2	4	5	3	2	1
Feedback	2	4	5	2	3	1
Update	2	3	5	2	4	1
Remediation	2	5	4	3	2	1
Flexibility	2	4	5	2	3	1
Human Interact	2	3	5	4	2	1
Leadership	2	4	5	3	2	1
Sensitivity	1	4	5	3	2	1
Transition	1	4	5	2	3	1
Pacing	1	5	2	4	3	1
Testing	1	5	4	2	3	1
Scope of Tasks	1	5	4	3	2	1
Scoring	1	5	3	2	4	1
Total		166	157	105	95	47

a workbook (WBK), and 35mm slides (35MM). The data represented in the table were taken from an evaluation conducted on the Interactive Videodisc, Device 11H89 (Pfeiffer, Miller, Platt, Green, Monroe, & Traxler, 1986). Some of these data have been transformed to aid in this illustration. By examining the table, one can see that the nineteen dimensions had differing levels of importance; consequently, the dimensions were grouped and weighted accordingly.

Based on these data, the interactive videodisc had the highest score and would be the normative choice. However, in light of cost estimates one may have to reconsider. Cost data were collected and are represented in Figure 3. Figure 3 depicts the present value costs against the training effectiveness rankings as computed by the MAUT method. Because of the much lower cost ($0.5 million) of the instructor-led group discussion versus the high cost ($2.5 million) of the interactive videodisc, the original normative choice of the interactive videodisc does not appear to be the correct one. In fact, considering the Decision Rules for Choosing Alternatives, Table 1 (p. 14), this example meets the third case of different life cycle cost and different training effectiveness; the rule states to select the higher training effectiveness and lower life cycle cost or use a subjective appraisal of the estimates with no specific rule to apply. Since neither alternative meets the first half of the rule, then the decision has to be made subjectively. By examining the differences of the estimates, it can be seen that the greatest difference is in the life cycle cost estimates. Therefore, in this analysis, the instructor-led group discussion should be chosen over the interactive videodisc.

In summary, the MAUT method combined with cost estimates produces a defensible rationale for decision making. This methodology provided the basis for developing the Research and Development Impact Analysis (RDIA). The following is a description of the RDIA with an explanation of the changes which were made to the MAUT method.

RESEARCH AND DEVELOPMENT IMPACT ANALYSIS (RDIA)

The Research and Development Impact Analysis is a variation of the Multi-Attribute Utility method and was a better fit for the four specific R&D projects. The RDIA bypassed some of the steps of the MAUT method. The alterations included:

- o General dimensions which may be appropriate for most programs were chosen over specific dimensions.

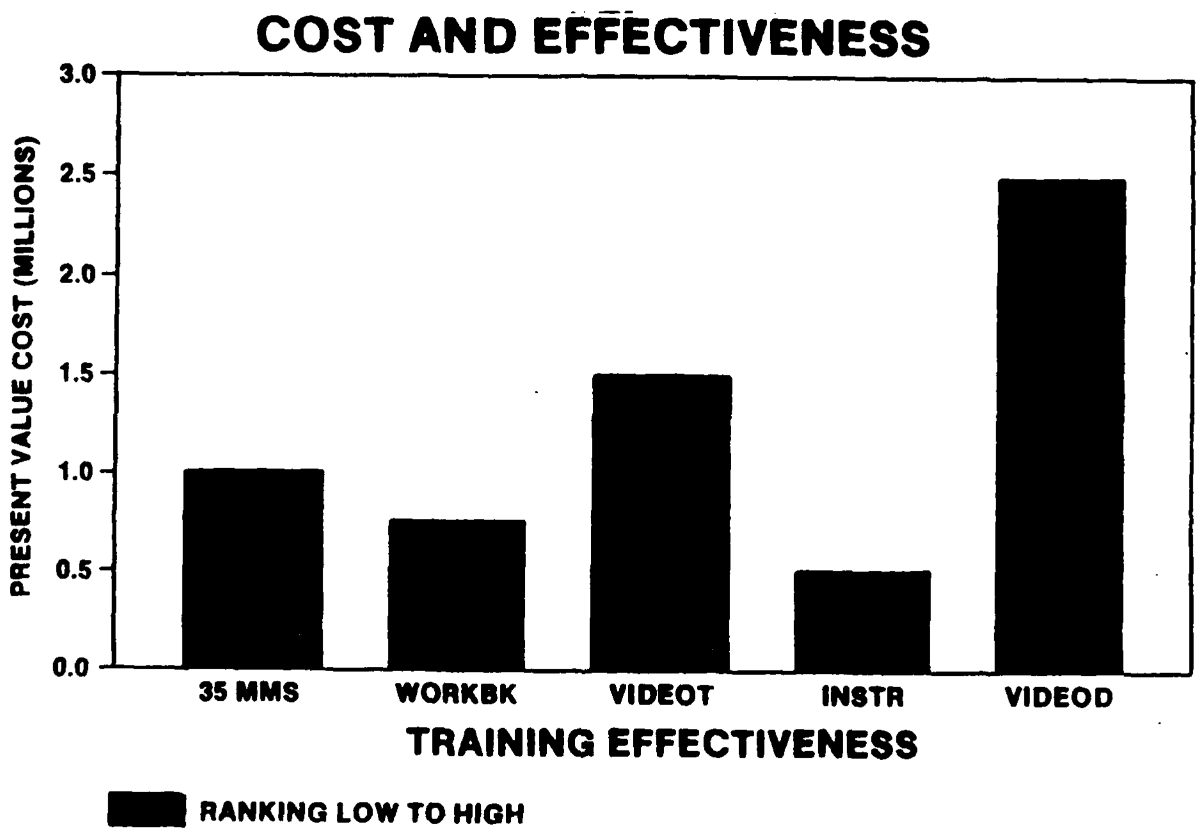


Figure 3. Present Value Costs vs Training Effectiveness Rankings.

- o The rating scales were designed to compare the proposed training R&D to a common alternative (i.e., the current training procedures) instead of comparing multiple alternatives.

- o The dimensions chosen had equal ranks and weights; importance weights can be added if deemed necessary.

The RDIA produces an overall score representing the difference between the R&D project/program and an existing alternative. The higher the score, the better the program is over that which is already in place. Appendix B contains copies of the RDIA as applied to the selected R&D programs.

COSTING APPROACH

This approach to costing is tailored to R&D projects. There is no comprehensive costing model, such as Knapp & Orlansky (1985), because at this stage in system/device development many resource requirements are unknown. Table 3 lists the steps necessary to do a basic cost analysis. This is a summary of the process described in the second edition of the DOD Economic Analysis Handbook.

The first task is a statement of the problem; where will this R&D product fit in the current training pipeline? Is it a substitute for something being done now or is it an enhancement/upgrade to an existing trainer/device? Before anything else can be started in the analysis, there must be a clear picture of the training requirements that the training R&D product will satisfy.

The second step is to identify alternatives that can satisfy these training requirements; there may be many or there may be none. This is the hardest and most important part of the analysis. Some alternatives may be dismissed because of constraints on labor, facilities, or funding.

Next, the resources needed to implement each alternative must be identified. Resources for acquisition and implementation, as well as resources used for R&D, should be included. The word "resource" includes manpower, equipment, supplies, facilities, and utilities. These resources are used in everything from maintenance to curriculum.

Table 3

Tasks Necessary to Perform a Cost Analysis

1. STATEMENT OF THE PROBLEM
2. IDENTIFY ALTERNATIVES
3. IDENTIFY RESOURCES REQUIRED FOR EACH ALTERNATIVE
4. DETERMINE COST OF THE RESOURCES
5. DETERMINE TOTAL COST OF EACH ALTERNATIVE
6. TIME PHASE-COMPUTE PRESENT VALUE
7. COMPARE PRESENT VALUE COST OF ALTERNATIVES

The resources identified for each alternative must then be costed. The per unit price of each "resource" and the amount used need to be estimated. The quantity consumed of a resource will depend on the time span; most of these analyses cover 10-15 years. Simplifying assumptions include (1) year 1 is all R&D expenditures; (2) year 2 is implementation; (3) steady state in all other years; and (4) inflation is assumed to be identical for all resource categories and therefore is excluded from the analysis.

To calculate the total costs of each alternative, step 5, a spreadsheet should be set up. Table 4 is a generic spreadsheet; it covers a ten-year period with major cost categories. For specific projects, of course, the time frame and the cost categories could be different. Student salaries are included and are defined as the value of the student time spent in training on a particular alternative.

To calculate this value, it is necessary to know the time spent by the average student, the number of students, and the salary of the average student. The other cost categories should be self-explanatory. Not all cost categories will have entries each year, such as training hardware which would be a one-time acquisition cost.

Table 4

Generic Cost Analysis Spreadsheet

Year	Development	Training Hardware	Facilities	Maintenance	Instructors	Student Salaries	Total Cost	Discounted Cost
1	$0	$0	$0	$0	$0	$0	$0	$0
2	$0	$0	$0	$0	$0	$0	$0	$0
3	$0	$0	$0	$0	$0	$0	$0	$0
4	$0	$0	$0	$0	$0	$0	$0	$0
5	$0	$0	$0	$0	$0	$0	$0	$0
6	$0	$0	$0	$0	$0	$0	$0	$0
7	$0	$0	$0	$0	$0	$0	$0	$0
8	$0	$0	$0	$0	$0	$0	$0	$0
9	$0	$0	$0	$0	$0	$0	$0	$0
10	$0	$0	$0	$0	$0	$0	$0	$0
Total	$0	$0	$0	$0	$0	$0	$0	$0

Table 4 has two total cost columns; the first is a straight summation across the rows, while the second is a discounted total cost, or a present value cost (step 6). This step is added because alternatives frequently have different expenditure patterns over time. For example, one project may spend most of its resources in the future, while an alternative may spend most of its resources up front. To calculate the discounted total cost for any given year, the undiscounted total cost (the preceding column) is multiplied by a discount factor; this factor reflects the change in the value of a dollar over time. Table 5 lists the discount factors for any analysis up to 25 years. If, in the sixth year of a project, expenditures are going to total $10,000,000, then the discounted cost would be $5,920,000 ($10,000,000 x 0.592).

The final step in the cost analysis is simply to compare the summation of the discounted costs of each alternative. For planning purposes, this cost is the better indicator of resource expenditures over time.

The factors are based on continuous compounding of interest assuming uniform cash flows throughout the one-year period. These factors are equivalent to an arithmetic average of beginning and end of year compound amount factors found in standard present value tables. Ten percent is used in this example since it is the DoD-established discount rate (DoDI 7041.3). The next section provides sample applications of this cost approach along with training effectiveness measures for the four R&D programs.

Table 5

Discount Factor

10% Present Value Table

PROJECT YEAR	PRESENT VALUE OF $1
1	0.954
2	0.867
3	0.788
4	0.717
5	0.652
6	0.592
7	0.538
8	0.489
9	0.445
10	0.405
11	0.368
12	0.334
13	0.304
14	0.276
15	0.251
16	0.228
17	0.208
18	0.189
19	0.172
20	0.156
21	0.142
22	0.129
23	0.117
24	0.107
25	0.097

SAMPLE APPLICATIONS OF IMPACT ANALYSES

Approximately 150 R&D projects/programs are in progress at the Naval Training Systems Center. These efforts differ on many factors such as purpose, scope, cost, quantifiability of results, etc. Code 7 chose for impact analyses the following projects/ programs as a cross representation of their many programs.

R&D PROGRAM DESCRIPTIONS

Embedded Training

This project is developing, demonstrating, and evaluating embedded training capability in the AN/SPA-25G radar repeater. The focus of this capability is to provide skill training in radar fundamentals for OS "A" School graduates, "pre-training" for AIC "C" School candidates, and refresher training for AIC "C" School graduates.

Trainer For Radar Intercept Operators (TRIO)

The TRIO system trains undergraduate naval flight officers in basic air intercept tactics. An important aspect of TRIO is its visual and operational simulation which incorporates sophisticated instructional facilities. For example, TRIO provides examples to the student using an expert system. The expert system performs intercepts and explains its actions and strategy to the student RIO. Also, TRIO generates performance analysis summaries containing specific error diagnostics after student practice runs.

Passive Acoustic Analysis Trainer (PAAT)

The PAA trainer uses high resolution displays and synchronized audio simulation to train sonar operators. Tactical tapes are processed at a software support facility to provide the same sonar information that a tactical operator would see and hear. This technique produces an exact replicate of the tactical environment represented by LOFAR grams. Realistic displays are generated by digitally duplicating the display that is obtained by playing a taped acoustic contact into a sonar set.

Marksmanship Training Simulator (MTS)

The MTS, sometimes referred to as the Markmanship Expert Trainer (MET), instructs rifle marksmanship to navy recruits without an instructor, real weapon, or rifle range. The system is controlled by a Zenith 248 personal computer. The MTS consists of six major parts: (a) long range light pen, (b) Zenith 248, (c) color monitor, (d) computer speech board, (e) analog and digital board, and (f) force sensing resistors.

A long range light pen is attached to an M-14 rifle and targets are displayed on the Zenith 248 monitor. The light pen is used to determine hits on the target and tracking steadiness. A breath sensor is placed around the trainee's diaphragm to determine if he held his breath while firing the weapon. A force sensing resistor is used on the trigger to determine how the trainee squeezed the trigger when firing the weapon. Feedback is provided by computer generated voice and monitor graphics. Bang and recoil of the weapon are also simulated.

SAMPLE APPLICATIONS

Approximately four to five Subject Matter Experts (SMEs) identified by the principal investigators of each of the R&D programs were administered the DEFT and the RDIA. Also a standard life-cycle cost analysis was performed to determine cost estimates. The remainder of this section will describe the outcome of applying this approach to the programs. Each program is treated separately and is presented in the following order: first, the DEFT results, then the results of the RDIA, and, finally, the cost determination estimates.

Embedded Training Analysis

DEFT. Each SME was instructed to rate a typical trainee on three dimensions within embedded training; i.e., (1) Visual Display, (2) Manual Control, and (3) Communication. Additionally, each SME was to use three frames of reference while rating the dimensions. These frames of reference were a typical trainee who had graduated from A School, a typical trainee who was a potential Air Intercept Control (AIC) student, and a typical trainee who was an Air Intercept Control graduate. Table 6 presents the composite scores and the total effectiveness score for the three dimensions and frames of reference. The DEFT scores were low suggesting that this embedded training system will be effective. Noteworthy is that the Communication Dimension had higher scores across all frames of reference. Of the three dimensions chosen, communication was least appropriate and, as expected, produced higher scores. Another area in which the DEFT was sensitive was for the pre-AIC graduate. Pre-AIC graduates learn rudimentary functions in A School and then are exposed to radar systems in the fleet; they are not usually familiar with the more complex tasks of the radar. The higher DEFT scores for the pre-AIC graduates reflect this phenomenon.

Table 6

DEFT Scores for Embedded Training

Dimension	A School	Pre AIC	Post AIC
		Training Problem	
Visual Display	5.05	20.63	0.86
Manual Control	1.20	6.64	0.14
Communication	36.75	31.50	2.41
		(Skill) Acquisition - Efficiency	
Visual Display	0.82	0.86	0.92
Manual Control	0.84	0.80	0.82
Communication	0.57	0.67	0.74
		(Skill) Acquisition	
Visual Display	6.16	23.99	0.93
Manual Control	1.43	8.30	0.17
Communication	64.47	47.01	3.26
		Transfer Problem	
Visual Display	35.00	50.00	15.00
Manual Control	37.50	47.5	13.75
Communication	56.67	52.50	26.25
		Transfer - Efficiency	
Visual Display	0.99	0.99	0.99
Manual Control	1.00	1.00	1.00
Communication	0.77	0.91	0.98
		Transfer	
Visual Display	35.35	50.51	15.15
Manual Control	37.50	47.50	13.75
Communication	73.60	57.69	26.79
		Total Effectiveness	
Visual Display	41.51	74.50	16.08
Manual Control	38.93	55.80	13.75
Communication	138.07	104.70	30.05

RDIA. The RDIA was given to the same SMEs who filled out the DEFT. Table 7 presents the ratings and total scores obtained from these SMEs. Converse to the DEFT, a higher score on the RDIA suggests a more effective training system. Out of a possible 45, each SME rated this system 34 or higher (the average total score was 36.5), again, suggesting an effective training system.

Cost Estimates. Table 8 shows the life cycle costs (LCC) associated with implementation of embedded training for AIC personnel. Simplifying assumptions are that development took place in Year 1 and equipment was installed in Year 2. Also, it was assumed that 300 ships would have this embedded training capability with each having one target generator and an average of seven Zenith 248 personal computers. This equipment is 90% of the $11.5 million LCC; the discounted (10% discount factor) LCC is $9.5 million. Personnel requirements were assumed to be unchanged from current training and therefore are not included.

Trainer for Radar Intercept Operator Analysis (TRIO)

DEFT. Three dimensions of the TRIO were rated. These dimensions were (1) Visual Display, (2) Audio Present, and (3) Oral Communication. Table 9 presents the results of applying the DEFT to the TRIO. The total effectiveness score and its composite scores were all low, thus, indicating an effective training system. Of the three dimensions, the Visual Display dimension produced the highest (worst) score.

RDIA. Table 10 presents the ratings and total scores for The TRIO as obtained from four SMEs. The average total score was 40; "availability to practice" and "feedback to the trainer" received the highest rating. According to the RDIA, the TRIO is an effective training system.

Cost Estimates. Table 11 shows the LCC associated with implementing TRIO into the training of F-14 radar intercept officers. Development and acquisition of TRIO is assumed to occur in the first two years of the 10 year life cycle. It is also assumed that the hardware for one TRIO unit is $35K; a total of 34 units would be purchased for the squadrons, reserve units, and Replacement Air Group Squadron. This equipment and the development costs of $1,285M would constitute about 85% of the LCC of $2,935M; the discounted LCC is $2.4M. Personnel requirements were assumed to be unchanged from current training and therefore not included.

Table 7

Research & Development Impact Analysis
for Embedded Training

Questions	Raters #1	#2	#3	#4	Mean
Training Time	5	4	4	4	4.25
Required Instructor Time	5	5	4	5	4.75
Training Content	2	4	4	4	3.50
User Acceptance	4	4	4	5	4.25
Instructor Acceptance	4	3	2	5	3.50
Availability to practice	5	5	5	5	5.00
Feedback to trainee	4	4	4	5	4.25
Student Performance Speed	3	3	3	4	3.25
Student Performance Accuracy	3	4	4	4	3.75
Total	35	36	34	41	36.50

Table 8

Life Cycle Costs for Embedded Training

Year	Development	Training Hardware	Facilities	Maintenance	Instructors	Student Salaries	Total Cost	Discounted Cost
1	$910,000	$0	$0	$0	$0	$0	$910,000	$827,273
2	$0	$10,500,000	$0	$10,000	$0	$0	$10,510,000	$8,685,950
3	$0	$0	$0	$10,000	$0	$0	$10,000	$7,513
4	$0	$0	$0	$10,000	$0	$0	$10,000	$6,830
5	$0	$0	$0	$10,000	$0	$0	$10,000	$6,209
6	$0	$0	$0	$10,000	$0	$0	$10,000	$5,645
7	$0	$0	$0	$10,000	$0	$0	$10,000	$5,132
8	$0	$0	$0	$10,000	$0	$0	$10,000	$4,665
9	$0	$0	$0	$10,000	$0	$0	$10,000	$4,241
10	$0	$0	$0	$10,000	$0	$0	$10,000	$3,855
	$910,000	$10,500,000	$0	$90,000	$0	$0	$11,500,000	$9,557,313

Table 9

DEFT Scores for the TRIO

Visual Display	Audio Present	Oral Communication
Training Problem		
22.55	9.34	24.94
(Skill) Acquisition - Efficiency		
0.94	0.95	0.95
(Skill) Acquisition		
23.99	9.83	26.25
Transfer Problem		
61.25	40.00	38.75
Transfer - Efficiency		
0.89	0.93	0.97
Transfer		
68.82	43.01	39.95
Total Effectiveness		
92.81	52.84	66.20

Table 10

Research & Development Impact Analysis
for the TRIO

Questions	Raters #1	#2	#3	#4	Mean
Training Time	3	5	4	3	3.75
Req'd Instr. Time	5	5	4	3	4.25
Training Content	4	3	3	3	3.25
User Acceptance	4	5	4	5	4.50
Instructor Acceptance	5	5	4	5	4.75
Availability to Practice	5	5	5	5	5.00
Feedback to Trainee	5	5	5	5	5.00
Student Performance Speed	4	5	5	5	4.75
Student Performance Accuracy	4	5	5	5	4.75
Total	39	43	39	39	40.00

Table 11

Life Cycle Costs for the TRIO

Year	Development	Training Hardware	Facilities	Maintenance	Instructors	Student Salaries	Total Cost	Discounted Cost
1	$1,285,000	$0	$0	$0	$0	$0	$1,285,000	$1,168,182
2	$0	$1,200,000	$0	$50,000	$0	$0	$1,250,000	$1,033,058
3	$0	$0	$0	$50,000	$0	$0	$50,000	$37,513
4	$0	$0	$0	$50,000	$0	$0	$50,000	$34,151
5	$0	$0	$0	$50,000	$0	$0	$50,000	$31,046
6	$0	$0	$0	$50,000	$0	$0	$50,000	$28,224
7	$0	$0	$0	$50,000	$0	$0	$50,000	$25,658
8	$0	$0	$0	$50,000	$0	$0	$50,000	$23,325
9	$0	$0	$0	$50,000	$0	$0	$50,000	$21,205
10	$0	$0	$0	$50,000	$0	$0	$50,000	$19,277
	$1,285,000	$1,200,000	$0	$450,000	$0	$0	$2,935,000	$2,421,691

Passive Acoustic Analysis Trainer (PAAT) Analysis

DEFT. The PAAT was rated on four dimensions: (1) Visual Display, (2) Audio Present, (3) Manual Control, and (4) Communication. Table 12 displays the results obtained from the SME ratings. The Audio Present dimension received the lowest (best) score of the four dimensions. However, all scores were low indicating an effective training system.

RDIA. This analysis also suggested an effective training system. Table 13 presents the ratings and total scores from each of four SMEs. None of the total scores was below 35, and five of the nine factors had a rating of 5. The only poor scoring factor was "training time." All SMEs marked that there would be an increase in training time using the PAAR versus using the current training system/procedures.

Cost Estimates. Table 14 shows the LCC of developing, purchasing, operating, and maintaining nine passive acoustic analysis trainers. Development takes place in Year 1 and amounts to $1.1M; acquisition of hardware and facilities preparation occur in Year 2 and cost $7.1M and $0.5M respectively. Maintenance of the devices is expected to be $225K annually. LCC were estimated to be $10.7M; the discounted LCC were $8.5M. Personnel requirements were assumed not to be higher than those used for current training and therefore were not included.

An alternative to using the PAAT would be the tactical equipment, the BQQ-5. The acquisition cost of one BQQ-5 is about $25M. If nine BQQ-5s could train as many students as nine PAATs (it would actually take more BQQ-5s), this option would cost approximately $300M for just the major hardware purchase, initial spares, and site preparation. Because of the huge difference in the hardware costs between the PAAT and the BQQ-5, a detailed LCC of the BQQ-5 alternative is not presented. These cost data are conclusive evidence that the PAAT is a less expensive option than the tactical equipment.

Marksmanship Training Simulator Analysis

DEFT. The MTS was rated on three dimensions. These dimensions were (1) Visual Display, (2) Audio Present, and (3) Manual Control. Table 15 displays the DEFT scores as computed from the ratings of the SMEs. The total effectiveness score and composite scores for all three dimensions were low and, therefore, indicated that the MTS is an effective training system. The Audio Present dimension had the lowest (best) score, while the Manual Control dimension had the highest (worst) score.

Table 12

DEFT Scores for the PAA Trainer

Visual Display	Audio Present	Manual Control	Communication
Training Problem			
2.88	3.36	23.50	15.12
(Skill) Acquisition - Efficiency			
0.93	0.91	0.94	0.78
(Skill) Acquisition			
3.10	3.69	25.00	19.38
Transfer Problem			
59.0	5.75	62.75	54.25
Transfer - Efficiency			
0.80	0.90	0.61	0.77
Transfer			
73.75	6.39	102.87	70.45
Total Effectiveness			
76.85	10.08	127.87	89.83

Table 13

Research & Development Impact Analysis for the PAA Trainer

Questions	Raters #1	#2	#3	#4	Mean
Training Time	1	1	1	1	1.00
Req'd Instr. Time	4	4	5	5	4.50
Training Content	5	5	5	4	4.75
User Acceptance	5	5	5	5	5.00
Instructor Acceptance	5	5	5	5	5.00
Availability to Practice	5	5	5	5	5.00
Feedback to Trainee	5	3.5	5	4	4.40
Student Performance Speed	5	5	5	5	5.00
Student Performance Accuracy	5	5	5	5	5.00
Total	40	38.5	41	39	39.6

Table 14

Life Cycle Costs for the PAA Trainer

Year	Development	Training Hardware	Site Prep Facilities	Maintenance	Instructors	Student Salaries	Total Cost	Discounted Cost
1	$1,100,000	$0	$0	$0	$0	$0	$1,100,000	$1,100,000
2	$0	$7,100,000	$500,000	$225,000	$0	$0	$7,825,000	$6,466,942
3	$0	$0	$0	$225,000	$0	$0	$225,000	$169,046
4	$0	$0	$0	$225,000	$0	$0	$225,000	$153,678
5	$0	$0	$0	$225,000	$0	$0	$225,000	$139,707
6	$0	$0	$0	$225,000	$0	$0	$225,000	$127,007
7	$0	$0	$0	$225,000	$0	$0	$225,000	$115,461
8	$0	$0	$0	$225,000	$0	$0	$225,000	$104,964
9	$0	$0	$0	$225,000	$0	$0	$225,000	$95,422
10	$0	$0	$0	$225,000	$0	$0	$225,000	$86,747
	$1,100,000	$7,100,000	$500,000	$2,025,000	$0	$0	$10,725,000	$8,458,974

Table 15

DEFT Scores for the MTS

Visual Display	Audio Present	Manual Control
Training Problem		
0.50	0.06	4.72
(Skill) Acquisition - Efficiency		
0.96	0.89	0.91
(Skill) Acquisition		
0.52	0.07	5.19
Transfer Problem		
14.20	5.40	32.40
Transfer - Efficiency		
0.83	0.85	0.91
Transfer		
17.11	6.35	35.60
Total Effectiveness		
17.63	6.42	40.79

__RDIA__. Six SMEs rated the MTS using this instrument. Table 16 presents the ratings and total scores obtained from these six experts. The total score for the MTS across all the SMEs was at least 34 or above (the average score was 36.70); the "student performance: speed and accuracy" factors received the highest average ratings (4.5). Over all, the RDIA suggests that the MTS is an effective training system.

__Cost Estimates__. Table 17 shows the LCC of the MTS for a ten-year period. Development costs are low because this is an adaptation of existing technology. The initial cost of simulators, $2.7M, and facilities, $3.1M, are relatively high. However, the biggest cost driver is personnel expenditures; this includes both additional instructors for RTC and student time in training. The LCC of this option is $90M; this is equivalent to a discounted LCC of $54M.

The LCC for the option using M-14s is shown in Table 18. Acquisition costs in Year 1 would include ranges, weapons, and troop transport (to the ranges). The major recurring costs would be for ammunition and personnel (instructors and training time). The LCC for this option is $141M or over 50% more than the MTS alternative (this percent also holds for the discounted LCC).

Both the DEFT and the RDIA indicated that all four R&D programs were training effective. Cost estimates provided additional information for decision making. The next section summarizes the analyses and offers guidelines for administering an impact analysis.

Table 16

Research & Development Impact Analysis
for the MTS

Questions	Raters #1	#2	#3	#4	#5	#6	Mean
Training Time	4	4	3.2	4	2	5	3.70
Req'd Instr. Time	4	4	5	5	2	3	3.80
Training Content	2	4	5	3	4	5	3.80
User Acceptance	4	3	5	4	4	5	4.20
Instructor Acceptance	3	3	5	3.3	4	5	3.90
Availability to Practice	4	4	4	4	5	3	4.00
Feedback to Trainee	3	4	5	5	4	5	4.30
Student Performance Speed	5	4	4	4	5	5	4.50
Student Performance Accuracy	5	4	4	4	5	5	4.50
Total	34	34	40.2	36.3	35	41	36.70

Table 17

Life Cycle Costs for the Marksmanship Training Simulator

Year	Development	Training Hardware	Site Prep Facilities	Maintenance	Instructors	Student Salaries	Total Cost	Discounted Cost
1	$150,000	$0	$0	$0	$0	$0	$150,000	$136,364
2	$0	$2,669,000	$3,100,000	$100,000	$2,500,000	$6,750,000	$15,119,000	$12,495,041
3	$0	$0	$0	$100,000	$2,500,000	$6,750,000	$9,350,000	$7,024,793
4	$0	$0	$0	$100,000	$2,500,000	$6,750,000	$9,350,000	$6,386,176
5	$0	$0	$0	$100,000	$2,500,000	$6,750,000	$9,350,000	$5,805,614
6	$0	$0	$0	$100,000	$2,500,000	$6,750,000	$225,000	$5,277,831
7	$0	$0	$0	$100,000	$2,500,000	$6,750,000	$225,000	$4,798,028
8	$0	$0	$0	$100,000	$2,500,000	$6,750,000	$225,000	$4,361,844
9	$0	$0	$0	$100,000	$2,500,000	$6,750,000	$225,000	$3,965,313
10	$0	$0	$0	$100,000	$2,500,000	$6,750,000	$225,000	$3,604,830
	$150,000	$2,669,000	$3,100,000	$900,000	$22,500,000	$60,750,000	$90,069,000	$53,855,835

Table 18

Life Cycle Costs for the M-14 Alternative

Year	Weapons	Ammo	Ranges	Troop Transport	Instructors	Student Salaries	Total Cost	Discounted Cost
1	$138,000	$1,235,000	$1,000,000	$600,000	$0	$0	$2,973,000	$2,702,727
2	$0	$1,235,000	$50,000	$60,000	$5,000,000	$9,000,000	$15,345,000	$12,681,818
3	$0	$1,235,000	$50,000	$60,000	$5,000,000	$9,000,000	$15,345,000	$11,528,926
4	$0	$1,235,000	$50,000	$60,000	$5,000,000	$9,000,000	$15,345,000	$10,480,841
5	$0	$1,235,000	$50,000	$60,000	$5,000,000	$9,000,000	$15,345,000	$9,528,038
6	$0	$1,235,000	$50,000	$60,000	$5,000,000	$9,000,000	$15,345,000	$8,661,851
7	$0	$1,235,000	$50,000	$60,000	$5,000,000	$9,000,000	$15,345,000	$7,874,411
8	$0	$1,235,000	$50,000	$60,000	$5,000,000	$9,000,000	$15,345,000	$7,158,556
9	$0	$1,235,000	$50,000	$60,000	$5,000,000	$9,000,000	$15,345,000	$6,507,778
10	$0	$1,235,000	$50,000	$60,000	$5,000,000	$9,000,000	$15,345,000	$5,916,162
	$138,000	$12,350,000	$1,450,000	$1,140,000	$45,000,000	$81,000,000	$141,078,000	$83,041,110

SUMMARY AND GUIDELINES

The previous section presented results obtained by administering the DEFT, administering the RDIA, and determining cost estimates for each of the targeted R&D programs. This section summarizes the results and refers back to the Decision Rules For Comparing Alternatives, Table 1 (p.2), to describe how the principal investigator or the sponsor can use the obtained information. Also, guidelines are presented for choosing the appropriate training effectiveness and cost measures for an impact analysis.

DATA SUMMARY

Table 19 presents a summary of the results for the four R&D programs. In order to make decisions using summative bottom line data, one needs to employ the rationale in Table 1, p.2. For example, the Marksmanship Training Simulator (MTS) received a low DEFT score, a high RDIA score, and the life cycle cost was estimated at $90M. Both the DEFT and the RDIA indicated that the MTS would be more training effective than the alternative method of training with live fire; and, the MTS was estimated as having a different life cycle cost ($90M vs $141M). Referring to Table 1, the summative data put the MTS in the third case; i.e., different training effectiveness and different life cycle cost. The rule from Table 1 states that in this circumstance the alternative with the higher training effectiveness and the lower life cycle cost should be selected. Consequently, the MTS should be chosen over the alternative method of training with live fire. This rationale can similarly be applied to the results of the other R&D programs.

Selecting the appropriate methodology for obtaining estimates of training effectiveness and costs is one of the most important initial steps that a principal investigator will take when performing an impact analysis. To obtain training effectiveness estimates, both the DEFT and the RDIA were applied to each program in this report. This was not necessary since both instruments produce measures of training effectiveness. This was done pedagogically to provide examples for demonstrating how an impact analysis can be performed. The remainder of this section proposes guidelines for selecting the appropriate training effectiveness measure and provides additional considerations for an impact analysis.

Table 19

Summary Results: R&D Project vs Alternative Compared on Effectiveness and Cost

R&D PROGRAM	ALTERNATIVE		
	Training Effectiveness	Life Cycle Cost $	Decision
Embedded Training	< Embedded Training	Fleet Exercise, Fuel, A/C Flight Training (Assume > Embedded Training)	Subjective - Select if funding is available
Passive Acoustic Analysis Trainer	< PAAT	> PAAT	Select PAAT
Marksmanship Training Simulator	< MTS	> MTS	Select MTS
Trainer for Radar Intercept Operator	< TRIO	> TRIO	Select TRIO

GUIDELINES

As stated previously, R&D programs differ on many factors such as purpose, scope, cost, quantifiability of results, etc. Some R&D programs are intended for demonstrating a training phenomenon, while others actually train; or, some programs involve an improved feature for an existing trainer; or, other programs are concerned with refresher training. Moreover, in some programs the training requirement may be better defined than in others. Therefore, prior to selecting an instrument which measures training effectiveness, the principal investigator should first determine which stage of development the program is in and also the kinds of data which are available.

There are a number of instruments, either in the literature or developed for a specific application, for measuring training effectiveness which are similar to the DEFT and the RDIA. These two were chosen for their versatility, flexibility, and applicability. Instruments such as the DEFT should be chosen if the R&D program actually trains or if the R&D program's training requirement is well defined. Instruments like the RDIA are recommended if the R&D program involves an improvement to an existing training system, if the proposed training research is intended only as a demonstration, or if the proposed training system is intended to be used for refresher training.

Once a particular approach/methodology has been determined, questions may arise concerning who identifies program attributes to be measured, who determines the importance of these attributes, and who rates/ranks the alternatives on the identified attributes. Although much depends on the progress and status of the research program, the following are recommended:

1. The principal investigator identifies the program attributes which should be measured.

2. The sponsor and/or ultimate users determine the importance of the identified attributes; i.e., weigh the importance of the attributes.

3. The ultimate user rates/ranks the alternatives based on the attributes; however, the principal investigator may be the best or only judge available.

4. Choose from among cost categories or variables those which capture as much as possible the cost of operating the status quo alternative as well as the cost of developing and implementing the R&D product.

In closing, the principles set forth in this report are offered only as guidelines which a principal investigator can use to provide estimates of cost and effectiveness to a sponsor or potential sponsor which would give them reliable information for determining the outcome of a program/project. Even though R&D programs may have similar characteristics, each program should be examined closely and treated uniquely within the recommended methodologies proposed here. Important funding decisions have to be made. Therefore, the onus is on the principal investigator to provide the best information he or she can obtain to support rational decisions.

REFERENCES

Cordell, C.C., & Nutter, R.A. (1983). Proposed policy and procedure for test and evaluation funded training device acquisitions (NAVTRASYSCEN Technical Note 5-831). Orlando, FL: Training Analysis and Evaluation Group.

Economic analysis handbook, 2nd edition, Defense Economic Analysis Council, 1975.

Hogarth, R.M. (1987). The psychology of decision. Chichester: John Wiley & Sons.

Knapp, M.I., & Orlansky, J. (1985). A comprehensive cost element structure for military training. Proceedings of the Symposium on the Military Value and Cost Effectiveness of Training, 29-53.

Pfeiffer, M.G. (1987). Analytic techniques for training effectiveness evaluations of systems/simulators/devices (NAVTRASYSCEN Technical Report 87-028). Orlando, FL: Naval Training Systems Center.

Pfeiffer, M.G., Miller, H.E., Platt, W.A., Green, E.K., Monroe, R.T., & Traxler, R.S. (1986). Evaluation of interactive videodisc (Device 11H89) (NAVTRASYSCEN Technical Report 86-004). Orlando, FL: Naval Training Systems Center.

Rose, A.M., Wheaton, G.R., & Yates, L.G. (1985). Forecasting device effectiveness: Volume I. issues (ARI Technical Report 680). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (NTIS No. AD-A159 576).

Rose, A.M., Wheaton, G.R., & Yates, L.G. (1985). Forecasting device effectiveness: Volume II: procedures (ARI Research Product). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences. (NTIS No. AD-A159-955).

Technical Report 88-017

APPENDIX A

DEFT QUESTIONNAIRES

Technical Report 88-017

DEVICE EFFECTIVENESS FORECASTING TECHNIQUE (DEFT)

1. Considering what you know about the following trainee's background, work experience, and prior training, what proportion of skills and knowledges required to meet the training objective(s) will the trainee still have to learn to reach criterion proficiency for each dimension shown below.

0=None; the trainee can already use this dimension of the device

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=All; the trainee has to learn to use this dimension of the device

2. Consider each task that a trainee won't be able to perform initially using Embedded Training. Rate the difficulty the trainee will have in using each dimension of Embedded Training.

1=Very easy to learn; it will take practically no training or practice to reach criterion proficiency on this dimension

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=Very difficult to learn; it will take a lot of training or practice to reach criterion proficiency on this dimension

3. Consider the performance deficits you have identified (see item 1). Rate how well Embedded Training will overcome these deficits.

1=Poor training of air intercept tasks

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=Good training of air intercept tasks

4. How well does each dimension of Embedded Training provide practice?

1=Little practice is provided

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=Extensive practice is provided

5. For each dimension, does Embedded Training provide qualitative feedback to the trainee?

0=Feedback is not provided

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=Lots of feedback is provided

6. Does Embedded Training provide a record of trainee performance when using the dimensions shown below?

0=No record of trainee performance is provided

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=Complete record of trainee performance is provided

7. Consider each dimension of Embedded Training you feel the trainee won't be able to use initially on the AN/SPA-25G. Rate the difficulty the trainee will have in learning to use each dimension.

1=Very easy to learn; it will take practically no training or practice on the AN/SPA-25G to reach criterion proficiency on this dimension

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=Very difficult to learn; it will take a lot of training or practice on the AN/SPA-25G to reach criterion proficiency on this dimension

8. Physical similarity is based on the similarity between physical characteristics of training and those of the operational situation. Rate the physical similarity between the AN/SPA-25G and its counterpart in Embedded Training.

0=No similarity; although the dimension is represented in Embedded Training, there would be a large noticeable difference quite apparent to the trainee at transfer and a large performance decrement, given that the trainee could use the dimension at all; specific instruction and practice would be required for this dimension on the AN/SPA-25G after transfer to overcome the deficit.

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=Identical; the trainee would not notice a difference between Embedded Training and the AN/SPA-25G for this dimension at the time of transfer

9. Functional similarity is based on the operator's behavior in terms of the information flow from auditory and/or visual displays to the operator and from the operator to each control. Rate the functional similarity for each dimension on the AN/SPA-25G and its counterpart (if any) in Embedded Training.

0=No similarity; for this dimension the trainee acts on completely different amounts and types of information in the Embedded Training situation and the AN/SPA-25G

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=Identical; for this dimension the trainee acts on the same types and amounts of information in Embedded Training and the AN/SPA-25G

10. Consider the statement of the operational performance objective(s), the training objective(s), and descriptions of the AN/SPA-25G and Embedded Training. Also, consider the instructional features and training principles that are included in Embedded Training to increase the probability that the skills and knowledges acquired will be used effectively on the AN/SPA-25G. For each dimension, rate how well Embedded Training will promote transfer to the AN/SPA-25G.

0=Dimension is not realistic, relevant or similar to the AN/SPA-25G

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=Dimension is relevant, realistic, or similar to the AN/SPA-25G

11. For the dimensions that must be used in Embedded Training, are the conditions of practice occurring late in training made to approximate those in the AN/SPA-25G?

0=Dimension does not approximate the AN/SPA-25G

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=Dimension approximates the AN/SPA-25G very well

12. For each dimension that must be used in the AN/SPA-25G, is an extensive amount of practice given in Embedded Training?

0=Not practiced in Embedded Training

Dimension	A-school Grad Rating	Pre-AIC Grad Rating	Post-AIC Grad Rating
Visual Display	______	______	______
Manual Control	______	______	______
Communication	______	______	______

100=Practiced extensively in Embedded Training

DEVICE EFFECTIVENESS FORECASTING TECHNIQUE (DEFT)

1. Considering what you know about the typical Naval Flight Officer's background, work experience, and prior training, what proportion of skills and knowledges required to meet the training objective(s) will the trainee still have to learn to reach proficiency on the trainer for radar intercept officers (TRIO) for each of the dimensions shown below.

0=None; the trainee can already use this dimension of the device

Dimension	Rating
Visual display	______
Audio present	______
Oral communication	______

100=All; the trainee has to learn to use this dimension of the device

2. Consider each air intercept task that a trainee won't be able to perform initially on TRIO. Rate the difficulty the typical Naval Flight Officer will have in using each dimension of TRIO.

1=Very easy to learn; it will take practically no training or practice to reach criterion proficiency on this dimension

Dimension	Rating
Visual display	______
Audio present	______
Oral communication	______

100=Very difficult to learn; it will take a lot of training or practice to reach criterion proficiency on this dimension

3. Consider the performance deficits you identified (see item 1). Rate how well using TRIO will overcome these deficits?

1=Poor training of radar intercept officer tasks

Dimension	Rating
Visual display	______
Audio present	______
Oral communication	______

100=Good training of radar intercept officer tasks

4. How well does each dimension of TRIO provide practice on air intercept tasks?

1=Little practice is provided

Dimension	Rating
Visual display	______
Audio present	______
Oral communication	______

100=Extensive practice is provided

5. For each dimension that is used, does TRIO provide qualitative feedback to the trainees about their performance?

0=Feedback not provided

Dimension	Rating
Visual display	______
Audio present	______
Oral communication	______

100=Lots of feedback provided

6. Does TRIO provide a record of trainee performance when using the dimensions shown below?

0=No record of trainee performance is provided

Dimension	Rating
Visual display	______
Audio present	______
Oral communication	______

100=Completed record of trainee performance is provided

7. Consider each dimension of TRIO you feel the typical trainee won't be able to use initially on the F-14. Rate the difficulty the typical student Naval Flight Officer will have in learning to use each dimension.

1=Very easy to learn; it will take practically no training or practice on the F-14 to reach criterion proficiency on this dimension

Dimension of actual equip	Rating
Visual display	______
Audio present	______
Oral communication	______

100=Very difficult to learn; it will take a lot of training or practice on the F-14 to reach criterion proficiency on this dimension

8. Physical similarity is based on the similarity between physical characteristics of the training and those of the F-14. Rate the physical similarity between the F-14 and its counterpart on the TRIO.

0=No similarity; although the dimension is represented in the TRIO, there would be a large noticeable difference quite apparent to the trainee at transfer and a large performance decrement, given that the trainee could use the dimension at all; specific instruction and practice would be required for this dimension on the F-14 after transfer to overcome the deficit

Dimension	Rating
Visual display	_______
Audio present	_______
Oral communication	_______

100=Identical; the trainee would not notice a difference between the TRIO and the F-14 for this dimension at the time of transfer

9. Functional similarity is based on the operator's behavior in terms of the information flow from auditory and visual displays to the operator and from the operator to each control. Rate the functional similarity for each dimension on the F-14 and its counterpart (if any) on the TRIO.

0=No similarity; for this dimension the trainee acts on completely different amounts and types of information on the TRIO and the F-14

Dimension	Rating
Visual display	_______
Audio present	_______
Oral communication	_______

100=Identical; for this dimension the trainee acts on the same types and amounts of information on the TRIO and the F-14

10. Consider the operational performance objective(s), the training objective(s), and descriptions of the F-14 and the TRIO. Also, consider the instructional features and training principles that are included in the TRIO to increase the probability that the skills and knowledges acquired will be used effectively on the F-14. For each dimension, rate how well TRIO will promote transfer of training to the F-14.

0=Dimension is not realistic, relevant or similar to the F-14

Dimension	Rating
Visual display	______
Audio present	______
Oral communication	______

100=Dimension is relevant, realistic, or similar to the F-14

11. For dimensions that must be used in TRIO, will the conditions of practice occurring late in training be made to approximate those in the F-14?

0=Dimension does not approximate the F-14

Dimension	Rating
Visual display	______
Audio present	______
Oral communication	______

100=Dimension approximates the F-14 very well

12. For the dimensions used in the F-14, is an extensive amount of practice given in the TRIO?

0=Not practiced in the TRIO

Dimension	Rating
Visual display	______
Audio present	______
Oral communication	______

100=Practiced extensively in the TRIO

Technical Report 88-017

DEVICE EFFECTIVENESS FORECASTING TECHNIQUE (DEFT)

1. Considering what you know about the typical trainee's background, work experience, and prior training, what proportion of skills and knowledges required to meet the training objective(s) will the trainee still have to learn to reach criterion proficiency on the Passive Acoustic Analysis Trainer (PAA) for each dimension shown below.

0=None; the trainee can already use this dimension of the device

Dimension	Rating
Visual Display	_____
Audio Present	_____
Manual Control	_____
Communication	_____

100=All; the trainee has to learn to use this dimension of the device

2. Consider each gram analysis that a trainee won't be able to perform initially on the PAA trainer. Rate the difficulty the typical trainee will have in using each dimension of the device.

1=Very easy to learn; it will take practically no training or practice to reach criterion proficiency on this dimension

Dimension	Rating
Visual Display	_____
Audio Present	_____
Manual Control	_____
Communication	_____

100=Very difficult to learn; it will take a lot of training or practice to reach criterion proficiency on this dimension

3. Consider the performance deficits (see item 1) you have identified. For each dimension, rate how well using the PAA trainer will overcome these deficits.

1=Poor training of gram analysis

Dimension	Rating
Visual Display	______
Audio Present	______
Manual Control	______
Communication	______

100=Good training of gram analysis

4. How well does each dimension of the PAA trainer provide practice?

0=Little practice is provided

Dimension	Rating
Visual Display	______
Audio Present	______
Manual Control	______
Communication	______

100=Extensive practice is provided

5. For each dimension that is used, does the PAA trainer provide qualitative feedback to the trainee?

0=Feedback not provided

Dimension	Rating
Visual Display	______
Audio Present	______
Manual Control	______
Communication	______

100=Lots of feedback provided

6. Does the PAA trainer provide a record of trainee performance when using the dimensions shown below?

0=No record of trainee performance is provided

Dimension	Rating
Visual Display	______
Audio Present	______
Manual Control	______
Communication	______

100=Complete record of trainee performance is provided

7. Consider each dimension of the PAA trainer you feel the typical trainee won't be able to use initially on the BQQ-3. Rate the difficulty the typical trainee will have in learning to use each dimension.

1=Very easy to learn; it will take practically no training or practice on the BQQ-3 to reach criterion proficiency on this dimension

Dimension	Rating
Visual Display	______
Audio Present	______
Manual Control	______
Communication	______

100=Very difficult to learn; it will take a lot of training or practice on the BQQ-3 to reach criterion proficiency on this dimension

8. Physical similarity is based on the similarity between physical characteristics of the training device and those of the BQQ-3. Rate the physical similarity between the BQQ-3 and its counterpart on the PAA trainer.

0=No similarity; although the dimension is represented in the PAA trainer, there would be a large noticeable difference quite apparent to the trainee at transfer and a large performance decrement, given that the trainee could use the dimension at all; specific instruction and practice would be required for this dimension on the BQQ-3 after transfer to overcome the deficit

Dimension	Rating
Visual Display	______
Audio Present	______
Manual Control	______
Communication	______

100=Identical; the trainee would not notice a difference between the PAA trainer and the BQQ-3 for this dimension at the time of transfer

9. Functional similarity is based on the operator's behavior in terms of the information flow from auditory and visual displays to the operator and from the operator to each control. Rate the functional similarity for each dimension on the BQQ-3 and its counterpart (if any) on the PAA trainer.

0=No similarity; for this dimension the trainee acts on completely different amounts and types of information in the PAA trainer and BQQ-3

Dimension	Rating
Visual Display	______
Audio Present	______
Manual Control	______
Communication	______

100=Identical; for this dimension the trainee acts on the same types and amounts of information in the PAA trainer and the BQQ-3

10. Consider the statement of the operational performance objective(s), the training objective(s), and descriptions of the BQQ-3 and the PAA trainer. Also, consider the instructional features and training principles that are included in the PAA trainer to increase the probability that the skills and knowledges acquired will be used effectively in the BQQ-3. For each dimension, rate how well the PAA trainer will promote transfer to the BQQ-3.

0=Dimension is not realistic, relevant, or similar to the BQQ-3

Dimension	Rating
Visual Display	______
Audio Present	______
Manual Control	______
Communication	______

100=Dimension is relevant, realistic, or similar to the BQQ-3

11. For dimensions that must be used in the PAA trainer, are the conditions of practice occurring late in training made to approximate those in the BQQ-3?

0=Dimension does not approximate the BQQ-3

Dimension	Rating
Visual Display	______
Audio Present	______
Manual Control	______
Communication	______

100=Dimension approximates the BQQ-3 very well

12. For dimensions that must be used in the BQQ-3, is an extensive amount of practice given in the PAA trainer?

0=Not practiced in the PAA trainer

Dimension	Rating
Visual Display	______
Audio Present	______
Manual Control	______
Communication	______

100=Practiced extensively in the PAA trainer

Technical Report 88-017

DEVICE EFFECTIVENESS FORECASTING TECHNIQUE (DEFT)

1. Considering what you know about the typical recruit's background, work experience, and prior training, what proportion of skills and knowledges required to meet the training objective(s) will the recruit still have to learn to reach criterion proficiency for each dimension shown below.

0=None; the recruit can already use this dimension of the device

Dimension	Rating
Visual display	______
Audio present	______
Manual control	______

100=All; the recruit has to learn to use this dimension of the device

2. Consider each marksmanship task that a recruit won't be able to perform initially on the marksmanship trainer (MET). Rate the difficulty the typical recruit will have in using each dimension of the trainer.

1=Very easy to learn; it will take practically no training or practice to reach criterion proficiency on this dimension

Dimension	Rating
Visual display	______
Audio present	______
Manual control	______

100=Very difficult to learn; it will take a lot of training or practice to reach criterion proficiency on this dimension

3. Consider the performance deficits you have identified (see item 1). Rate how well using the MET will overcome these deficits.

1=Poor training of marksmanship

Dimension	Rating
Visual display	______
Audio Present	______
Manual control	______

100=Good training of marksmanship

4. How well does each dimension of the MET provide practice?

1=Little practice is provided

Dimension	Rating
Visual display	______
Audio Present	______
Manual control	______

100=Extensive practice is provided

5. For each dimension that is used, does the MET provide qualitative feedback to the trainees?

0=Feedback not provided

Dimension	Rating
Visual display	______
Audio present	______
Manual control	______

100=Lots of feedback provided

6. Does the MET provide a record of trainee performance when using the dimensions shown below?

0=No record of trainee performance is provided

Dimension	Rating
Visual display	______
Audio present	______
Manual control	______

100=Complete record of trainee performance is provided

7. Consider each dimension of the MET you feel the typical recruit won't be able to use initially using "live fire." Rate the difficulty the typical recruit will have in learning to use each dimension.

1=Very easy to learn; it will take practically no training or practice when using "live fire" to reach criterion proficiency on this dimension

Dimension of actual equip	Rating
Visual display	______
Audio present	______
Manual control	______

100=Very difficult to learn; it will take a lot of training or practice when using "live fire" to reach criterion proficiency on this dimension

8. Physical similarity is based on the similarity between physical characteristics of the training device and those of the actual situation. Rate the physical similarity between using "live fire" and its counterpart on the MET.

0=No similarity; although the dimension is represented in the MET, there would be a large noticeable difference quite apparent to the recruit at transfer and a large performance decrement, given that the recruit could use the dimension at all; specific instruction and practice would be required for this dimension when using "live fire" after transfer to overcome the deficit

Dimension	Rating
Visual display	______
Audio present	______
Manual control	______

100=Identical; the recruit would not notice a difference between the MET and using "live fire" for this dimension at the time of transfer

9. Functional similarity is based on the operator's behavior in terms of the information flow from auditory and visual displays to the operator and from the operator to each control. Rate the functional similarity for each dimension using "live fire" and its counterpart (if any) on the MET.

0=No similarity; for this dimension the recruit acts on completely different amounts and types of information in the MET and using "live fire"

Dimension	Rating
Visual display	______
Audio present	______
Manual control	______

100=Identical; for this dimension the recruit acts on the same types and amounts of information in the MET and using "live fire"

10. Consider the statement of the operational performance objective(s), the training objective(s) and descriptions of the MET. Also, consider the instructional features and training principles that are included in the MET to increase the probability that the skills and knowledges acquired will be used effectively when using "live fire." For each dimension, rate how well the MET will promote transfer to the "live fire" situation.

0=Dimension is not realistic, relevant or similar to the "live fire" situation

Dimension	Rating
Visual display	______
Audio present	______
Manual control	______

100=Dimension is relevant, realistic, or similar to the "live fire" situation

11. For dimensions that must be used in the MET, are the conditions of practice occurring late in training made to approximate those in the "live fire" situation?

0=Dimension does not approximate the "live fire" situation

Dimension	Rating
Visual display	______
Audio present	______
Manual control	______

100=Dimension approximates the "live fire" situation very well

12. For dimensions that must be used in the "live fire" situation, is an extensive amount of practice given in the MET?

0=Not practiced in the MET

Dimension	Rating
Visual display	______
Audio present	______
Manual control	______

100=Practiced extensively in the MET

Technical Report 88-017

APPENDIX B

RDIA QUESTIONNAIRES

EVALUATION OF EMBEDDED TRAINING

When answering the following items, compare the current training system/procedures with the addition of the proposed RDT&E training system/procedures (i.e., Embedded Training). Indicate what changes in the following factors will occur with the implementation of the RDT&E system/procedures (Please circle one number).

<u>Change in:</u>

Training time	1 Decrease	2	3 No change	4	5 Increase
Required instructor time	1 Decrease	2	3 No change	4	5 Increase
Training content	1 Decrease	2	3 No change	4	5 Increase
User acceptance	1 Decrease	2	3 No change	4	5 Increase
Instructor acceptance	1 Decrease	2	3 No change	4	5 Increase
Availability to practice	1 Decrease	2	3 No change	4	5 Increase
Feedback to trainee	1 Decrease	2	3 No change	4	5 Increase

Student performance: speed	1 Decrease	2	3 No change	4	5 Increase
Student performance: accuracy	1 Decrease	2	3 No change	4	5 Increase

Additional comments ______________________________________

____

____

____

____

____

____

EVALUATION OF TRAINER FOR RADAR INTERCEPT OFFICERS

When answering the following items, compare the current training system/procedures with the addition of the proposed RDT&E training system/procedures (i.e., TRIO). Indicate what changes in the following factors will occur with the implementation of the RDT&E system/procedures (Please circle one number).

Change in:

Training time	1 Decrease	2	3 No change	4	5 Increase
Required instructor time	1 Decrease	2	3 No change	4	5 Increase
Training content	1 Decrease	2	3 No change	4	5 Increase
User acceptance	1 Decrease	2	3 No change	4	5 Increase
Instructor acceptance	1 Decrease	2	3 No change	4	5 Increase
Availability to practice	1 Decrease	2	3 No change	4	5 Increase
Feedback to trainee	1 Decrease	2	3 No change	4	5 Increase

	1	2	3	4	5
Student performance: speed	1 Decrease	2	3 No change	4	5 Increase
Student performance: accuracy	1 Decrease	2	3 No change	4	5 Increase

Additional comments ______________________________________

____

____

____

____

____

____

Technical Report 88-017

EVALUATION OF PASSIVE ACOUSTIC ANALYSIS TRAINER

When answering the following items, compare the current training system/procedures (i.e., BQQ-3) with the proposed RDT&E training system/procedures (i.e., PAA trainer). Indicate what changes in the following factors will occur with the implementation of the RDT&E system/procedures (Please circle one number).

<u>Change in:</u>

Change in	1	2	3	4	5
Training time	1 Decrease	2	3 No change	4	5 Increase
Required instructor time	1 Decrease	2	3 No change	4	5 Increase
Training content	1 Decrease	2	3 No change	4	5 Increase
User acceptance	1 Decrease	2	3 No change	4	5 Increase
Instructor acceptance	1 Decrease	2	3 No change	4	5 Increase
Availability to practice	1 Decrease	2	3 No change	4	5 Increase
Feedback to trainee	1 Decrease	2	3 No change	4	5 Increase

	1	2	3	4	5
Student performance: speed	1 Decrease	2	3 No change	4	5 Increase
Student performance: accuracy	1 Decrease	2	3 No change	4	5 Increase

Additional comments ______________________________________

____

____

____

____

____

____

EVALUATION OF MARKSMANSHIP EXPERT TRAINER

When answering the following items, compare the current training system/procedures (i.e., live fire) with the proposed RDT&E training system/procedures (i.e., MET). Indicate what changes in the following factors will occur with the implementation of the RDT&E system/procedures (Please circle one number).

<u>Change in:</u>

	1	2	3	4	5
Training time	1 Decrease	2	3 No change	4	5 Increase
Required instructor time	1 Decrease	2	3 No change	4	5 Increase
Training content	1 Decrease	2	3 No change	4	5 Increase
User acceptance	1 Decrease	2	3 No change	4	5 Increase
Instructor acceptance	1 Decrease	2	3 No change	4	5 Increase
Availability to practice	1 Decrease	2	3 No change	4	5 Increase
Feedback to trainee	1 Decrease	2	3 No change	4	5 Increase

Student performance: speed	1 Decrease	2	3 No change	4	5 Increase
Student performance: accuracy	1 Decrease	2	3 No change	4	5 Increase

Additional comments ______________________________

____

____

____

____

____

Technical Report 88-017

DISTRIBUTION LIST

Navy

OASN (M&RA)
CNO (OP-01B7, OP-09B31, OP111J2, OP-987H, OP-01B2E1)
ONR (422 (3 copies))
ONT (Code 222)
CNET (L02) (B. Williams)
CNAVRES (02)
COMNAVAIRSYSCOM (PMA205, AIR-933G)
CNTECHTRA (016, N6)
CNATRA (Library)
COMTRALANT (Educational Advisor)
COMTRAPAC (2 copies)
NAVSEA (CEL/MP-63)
NATC Code SY30)
CO NAVPERSRANDCEN (Library, Educational Advisor)
Superintendent NAVPGSCOL (Library)
CO NAVEDTRAPRODEVCEN (Technical Library (2 copies))
CO NAVEDTRASUPPCENLANT (N3 (2 copies))
CO NAVEDTRASUPPCENPAC (2 copies)
Center for Naval Analyses (2 copies)
OIC NODAK (2)
CO NAVTRASYSCEN (Code 1, 10 (2 copies), 12, TIC, 7, 001, 002, 03)

Air Force

HQ AFSC/XTHS Andrews Air Force Base
Air Force Human Resources Laboratory, Brooks Air Force Base (2 copies)
Air Force Office of Scientific Research/NL
4235 Strategic Training Squadron, Carswell Air Force Base
ASD, Wright-Patterson Air Force Base
OLAC, HSD/YA, Wright-Patterson Air Force Base

Army

Commander, TRADOC (Technical Library, ATTG-1)
ARI (Technical Director, PERI-SM, PERI-IC, Library (2 copies)
ARI Field Unit, Fort Leavenworth
ARI Reference Service
ARI Field Unit, Fort Knox (PERI-1K)
U.S. Army Headquarters (OAPE-ZXO)
PM Trade, Orlando, FL.

DISTRIBUTION LIST (Continued)

Coast Guard

Commandant, Coast Guard Headquarters (G-P-1/2142, GRT/54)

Marine Corps

CMC (OT, TAP-40)
CGMCDEC
Director, Marine Corps Institute

Other

Military Assistant for Human Resources, OUSDR&E, Pentagon
DTIC (12 copies)
Training Performance Data Center, Orlando, FL.
Office of Under Secretary of Defense, Washington, D.C.
Department of Defense Headquarters, Washington, D. C.
Eagle Technology, Arlington, VA.
Institute for Defense Analyses, Alexandria, VA.
RAAFFNTT, WAGGA, N.S.W. Australia (A. House)